

OFFSHORING, INTELLECTUAL PROPERTY RIGHTS AND ASSOCIATED RISKS

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OUTLINE OF THE PRESENTATION

INTRODUCTION

Model and Data

OFFSHORING FLOWS

Results

CONCLUSIONS



- Offshoring occurs when a firm decides to send part of its production process to another country.
- A broad literature has been produced. It seeks which factors influence the decision of firms to carry out part of their production process outside the borders of their country.
- We consider that Intellectual Property Rights (IPRs) and different types of risks are important factors in offshoring flows due to these variables can affect transaction costs and agency costs.

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Contribution:

- We conduct a complete analysis incorporating IPRs and country risk.
- We use the measure of Canals & Sener (2014) but for a wider sample of countries.
- Our analysis distinguishes between developing and developed countries, as well as high- and low-tech industries.

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Hypotheses

- **Hypothesis 1:** The higher the perception of IPR protection in a country is, the greater the offshoring it will receive.
- **Hypothesis 2:** The higher the macroeconomic stability of a country is, the higher the offshoring flows it will receive.

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MODEL AND DATA Offshoring Measures

• We follow Canals & Sener (2014) to construct the two offshoring measures (broad and narrow). They are based on the OECD Input-Output tables and UN Comtrade import data.

$$\mathcal{O}_{hcit}^{broad} = \sum_{j} a^{h}_{ijt} * rac{\mathcal{M}^{h}_{cjt}}{C^{h}_{jt}}$$

• It measures the dollar value of intermediate goods (inputs) that industry *i* in country *h* imports from all industries (*j*) in country *c* for production in year *t*.

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MODEL AND DATA Offshoring Measures

$$\mathcal{O}_{hcit}^{narrow} = a^h_{iit} * rac{M^h_{cit}}{C^h_{it}}$$

- The *narrow* measure indicates the dollar value of inputs that industry *i* in country *h* imports from the same industry in country *c* for production at time *t*.
- In both measures, country *h* and *c* are the ones that import and export respectively; in conceptual terms they are the countries that send and receive offshoring flows, respectively.

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Offshoring Flows

STRUCTURE OF OFFSHORING FLOWS RECEIVED BY DESTINATION COUNTRIES

Broad Measure



FIGURE: Developed Countries



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MODEL AND DATA ECONOMETRIC MODEL - BROAD MEASURE

• To contrast our hypotheses, we use the following model based in Canals & Sener (2014) and Branstetter, Fritz & Saggi (2010). The empirical model used is:

$$Ln(O_{hci,t}^{broad}) = \alpha_t + \alpha_i + \alpha_1 B_{h,t-1} + \alpha_2 C_{c,t-1} + \alpha_3 IPR_{hc,t-1} + \alpha_4 R_{hc,t-1} + \alpha_5 HT_i + \alpha_6 IPR_{hc,t-1}HT_i + \alpha_7 R_{hc,t-1}HT_i + \alpha_8 Dev_c + \alpha_9 IPR_{hc,t-1}Dev_c + (1) \alpha_{10} R_{hc,t-1}Dev_c + \varepsilon_{cit}$$

- where *t* is the time, *h* is the origin country, *c* is the destination country and *i* is the industry in the origin country.
- Equation (1) is estimated through a Fixed Effect Model.



- α_t and α_i represent the industry- and time-fixed effects.
- *B_{ht}* and *C_{ct}* are control variables of origin country and destination country, respectively.
- *IPR_{hct}* is the relative measure of intellectual property rights. It is the ratio between the strength of destination country and that of the origin country.
- *R*_{hct} is a relative measure for the sovereign rating assigned to country *c* relative to country *h* by Standard & Poor's.
- Dev_c is 1 if the destination country is developed and 0 otherwise.
- *HT_i* is 1 if the industry in the origin country is high-tech and 0 otherwise.

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MODEL AND DATA ECONOMETRIC MODEL - NARROW MEASURE

• When we consider the *Narrow* measure, we see that almost half of the observations concentrate on zero. For this reason the following equation is estimated using a Tobit model with random effects.

$$Ln(O_{hcit}^{narrow})^{*} = \beta_{t} + \beta_{i} + \beta_{1}B_{h,t-1} + \beta_{2}C_{c,t-1} + \beta_{3}IPR_{hc,t-1} + \beta_{4}R_{hc,t-1} + \beta_{5}HT_{i} + \beta_{6}IPR_{hc,t-1}HT_{i} + \beta_{7}R_{hc,t-1}HT_{i} + \beta_{8}Dev_{c} + \beta_{9}IPR_{hc,t-1}Dev_{c} +$$
(2)
$$\beta_{10}R_{hc,t-1}Dev_{c} + \epsilon_{cit}$$

• Where the selection equation is:

$$dOff_{hcit} = \begin{cases} 1, & \text{if } \pi Ln(O_{hcit}^{intra})^* = F(X'_{hcit}\theta + u_{hcit}) > 0\\ 0, & \text{otherwise} \end{cases}$$
(3)

• In this way, we observe

$$Ln(O_{hcit}^{lntra}) = \begin{cases} Ln(O_{hcit}^{lntra})^* & \text{if } dOff_{hcit} = 1\\ 0 & \text{if } dOff_{hcit} = 0 \end{cases}$$
(4)

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MODEL AND DATA Main Variables

- Heritage Foundation creates a property rights index based on information from the Economist Intelligence Unit, the Department of Commerce, etc. The index evaluates the extent to which a country's laws protect private property rights and also measures the extent which government enforces these laws.
- With respect to country risk, we use the rating assigned by Standard & Poor's. Higher ratings reflect safer countries.



- GDP, GDPpc, exchange rate and trade openness are taken from World Bank.
- We are based on the United Nations (2000) to classify countries according to their level of development.
- For the technological classification of the industries, we take as a reference the aggregation of the manufacturing and services industries from NACE Rev. 2.

Model and Data

- The complete sample contains up to 1,049,674 observations.
- The sample period is from 2000 to 2011.
- 12 industries are considered high-tech and 19 low-tech.
- The sample of countries is distributed as follows:

| Table 1a. Origin Countries | | | Table 1b. Destination Countries | | | |
|----------------------------|-----------|------------|---------------------------------|-----------|------------|--|
| Continent | Developed | Developing | Continent | Developed | Developing | |
| Africa | 0 | 3 | Africa | 0 | 11 | |
| America | 2 | 7 | America | 2 | 17 | |
| Asia | 1 | 14 | Asia | 1 | 17 | |
| Europe | 19 | 12 | Europe | 16 | 10 | |
| Oceania | 2 | 0 | Oceania | 2 | 0 | |
| Total | 24 | 36 | Total | 21 | 55 | |

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MODEL AND DATA Statistical Analysis

Table 2. Descriptive Statistics (Averages) of Main Variables

| | | | | | | Difference of Mean Test | |
|----------------------------------|-------|-------------|-------------|----------------|----------------|-------------------------|---------------------|
| | | | | | | Level of Development | Technological Level |
| | | Destination | Destination | Low-Tech | High-Tech | | |
| Variable | All | Developing | Developed | Industry in | Industry in | p-value | p-value |
| | | Country | Country | Origin Country | Origin Country | | |
| Ln(O ^{Broad}) | 12.91 | 12 | 15,76 | 12,88 | 12,96 | 0 | 0 |
| Ln(O ^{Narrow}) | 5.23 | 4,46 | 7,61 | 5,38 | 4,99 | 0 | 0 |
| Rel. Sovereign Ratinghc | 1.04 | 0.85 | 1.55 | 1.04 | 1.04 | 0 | 0,66 |
| Relative IPR _{hc} | 1.07 | 0.88 | 1.66 | 1.07 | 1.07 | 0 | 0,66 |
| $Ln(GDP_h)$ | 26.24 | 26,27 | 26,15 | 26,24 | 26,24 | 0 | 0,76 |
| $Ln(GDP_c)$ | 25.35 | 24,86 | 26,88 | 25,35 | 25,35 | 0 | 0,99 |
| $Ln(GDPpc_h)$ | 9.67 | 9,7 | 9,6 | 9,67 | 9,67 | 0 | 0,3 |
| Ln(GDPpc _c) | 9.12 | 8,59 | 10,74 | 9,12 | 9,12 | 0 | 1 |
| Ln(Exchange Rate _h) | 1.88 | 1,84 | 1,99 | 1,88 | 1,88 | 0 | 0,4 |
| Ln(Exchange Rate _c) | 2.45 | 2,99 | 0,78 | 2,45 | 2,45 | 0 | 0,83 |
| Ln(Trade Openness _c) | 4.37 | 4,38 | 4,31 | 4,37 | 4,37 | 0 | 0,89 |

Notes: (i) IPR: Intellectual property rights. (ii) Ln: Natural logarithm. (iii) pc: per capita. (iv) h: Origin country of offshoring flows;

c: Destination country of offshoring flows.

Source: Own calculations from the constructed database.

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RESULTS BROAD MEASURE

| Table 3. Effect of overall conditions on offshoring flows using the broad measure | | | | | |
|--|----------------|-------------------|------------------|--|--|
| | (1) | (2) | (3) | | |
| Denordent Marialia (OBroad) | All Commission | Origin Developing | Origin Developed | | |
| Dependent variable: Ln(O _{hcit}) | All Countries | Countries | Countries | | |
| $Ln(GDP_{h,t-1})$ | 2.432*** | 2.996*** | 0.744*** | | |
| | (0.0430) | (0.0681) | (0.1051) | | |
| $Ln(GDP_{c,t-1})$ | 1.820*** | 1.671*** | 2.250*** | | |
| | (0.0328) | (0.0489) | (0.0500) | | |
| Relative GDP per capita _{hc.t-1} | -0.017*** | -0.006** | -1.441*** | | |
| | (0.0026) | (0.0027) | (0.0976) | | |
| Ln(Exchange Rate _{h.t-1}) | 0.060*** | 0.246*** | 0.029*** | | |
| | (0.0069) | (0.0167) | (0.0079) | | |
| Ln(Exchange Rate _{c.t-1}) | -0.079*** | -0.065*** | -0.188*** | | |
| | (0.0149) | (0.0216) | (0.0195) | | |
| Ln(Trade Openness _{c.t-1}) | 0.435*** | 0.486*** | 0.376*** | | |
| | (0.0204) | (0.0298) | (0.0272) | | |
| Relative Sovereign Rating _{hc,t-1} | -0.045*** | -0.038*** | -0.376*** | | |
| | (0.0034) | (0.0034) | (0.0562) | | |
| Category _i * Relative Sovereign Rating _{hc,t-1} | -0.004 | -0.004 | -0.018 | | |
| | (0.0027) | (0.0027) | (0.0739) | | |
| Development _c * Relative Sovereign Rating _{hc,t-1} | 0.038*** | 0.035*** | -0.916*** | | |
| | (0.0032) | (0.0032) | (0.0829) | | |
| Relative IPR _{hc,t-1} | 0.183*** | 0.167*** | 0.054 | | |
| | (0.0144) | (0.0154) | (0.0431) | | |
| Category _i * Relative IPR _{hc,t-1} | 0.005 | -0.008 | 0.178*** | | |
| | (0.0163) | (0.0169) | (0.0575) | | |
| Development _c * Relative IPR _{hc,t-1} | -0.123*** | -0.126*** | 0.188*** | | |
| | (0.0160) | (0.0168) | (0.0547) | | |
| | | | | | |
| Observations | 1,049,674 | 604,952 | 444,722 | | |
| R-squared | 0.185 | 0.194 | 0.170 | | |
| Notes: (i) Robust standard errors clustered by origin-destination country in parentheses (*** $p < 0.01$, | | | | | |

Notes: (i) Robust standard errors clustered by origin-destination country in parentheses (*** p-0.01, **; p-0.02, **; p-0.01, (ii) b; c) rigin country of offshoring flows; c) Testination country of offshoring flows; (iii) All estimates include constant, industry- and time-fixed effects. (iv) According to Equations 1 and 2, the variable Category refers to the technological level of the industry located in country h that imports inputs from country c.

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RESULTS NARROW MEASURE

| Table 4. Effect of overall conditions on offshoring flows using the narrow measure | | | | | |
|---|--|---|--|--|--|
| (1) | (2) | (3) | | | |
| All Countries | Origin Developing | Origin Developed | | | |
| All Countries | Countries | Countries | | | |
| 1.423*** | 1.168*** | 1.393*** | | | |
| (0.0110) | (0.0180) | (0.0139) | | | |
| 2.373*** | 2.553*** | 2.165*** | | | |
| (0.0116) | (0.0169) | (0.0154) | | | |
| -0.063*** | -0.058*** | -0.558*** | | | |
| (0.0022) | (0.0025) | (0.0555) | | | |
| -0.118*** | -0.083*** | -0.118*** | | | |
| (0.0069) | (0.0098) | (0.0116) | | | |
| -0.181*** | -0.176*** | -0.186*** | | | |
| (0.0074) | (0.0107) | (0.0098) | | | |
| 1.436*** | 1.634*** | 1.288*** | | | |
| (0.0257) | (0.0378) | (0.0345) | | | |
| -0.106*** | -0.084*** | -0.052 | | | |
| (0.0064) | (0.0071) | (0.0832) | | | |
| 0.023*** | 0.018** | 0.394*** | | | |
| (0.0073) | (0.0080) | (0.1136) | | | |
| 0.067*** | 0.054*** | -0.920*** | | | |
| (0.0073) | (0.0080) | (0.1462) | | | |
| 0.092*** | 0.139*** | 0.307*** | | | |
| (0.0215) | (0.0253) | (0.0694) | | | |
| 0.145*** | 0.069** | 0.780*** | | | |
| (0.0267) | (0.0312) | (0.0993) | | | |
| -0.113*** | -0.183*** | -0.278** | | | |
| (0.0269) | (0.0313) | (0.1224) | | | |
| 1.407*** | 1.619*** | 2.617*** | | | |
| (0.0592) | (0.0853) | (0.1789) | | | |
| | | | | | |
| 502,329/547,345 | 270,823/334,129 | 231,506/213,216 | | | |
| 1,049,674 | 604,952 | 444,722 | | | |
| Notes: (i) Robust standard errors clustered by origin-destination country in parentheses (*** p<0.01, ** p< | | | | | |
| | g flows using the r (1) All Countries 1.423*** (0.0110) 2.373*** (0.0110) 2.373*** (0.0069) -0.181*** (0.0069) -0.181*** (0.0069) -0.181*** (0.0069) -0.181*** (0.0064) 0.023*** (0.0064) 0.025** (0.0064) 0.025** (0.0064) 0.025** (0.0064) 0.025** (0.0064) 0.025** (0.0064) 0.025** (0.0067** (0.0067** (0.0067) 0.049*** (0.0069) 1.049*** (0.0069) 1.049*** (0.0069) 1.049*** (0.0067) 1.049*** (0.0069) 1.049*** (0.0067) 1.049*** (0.0069) 1.049 | g flows using the narrow measure (1) (2) All Countries Orgin Developing Countries 1.423*** 1.166*** (0.0110) (0.0180) 2.373*** 2.553*** (0.0116) (0.0169) -0.063*** -0.058*** (0.0000) (0.0169) (0.0025) (0.0075) -0.118*** -0.063*** (0.0074) (0.0107) 1.434*** 1.634*** (0.0277) (0.0378) -0.018*** -0.064*** (0.0277) (0.0378) -0.023*** 0.018** (0.0273) (0.0600) 0.027** 0.054*** (0.025) (0.0253) 0.165*** 0.069*** (0.0253) (0.0253) 0.145*** 0.069*** (0.0252) (0.0331) 1.407*** 1.619**** (0.0252) (0.0633) 1.407*** 1.619**** (0.0252) (0.0633) 1.407*** | | | |

Note: (i) to be considered to the case of the second county in particular (i) to be considered (ii) to be considered (iii) to be considered (iiii) to be considered (iii) to be considered (iiii) to be considered (iiiii) to be considered (iiii) to be considered (iiiii) to be

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OFFSHORING AND ITS DETERMINANTS

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- Developed countries receive more offshoring flows in high-tech industries than developing countries.
- Under most specifications, we found that countries with relatively stronger IPRs attract higher offshoring flows. (Hypothesis 1)
- High-tech industries located in developed countries are more sensitive to relative changes in strength of IPRs.
- Firms located in developed countries are more sensitive to relative changes in strength of IPRs when *narrow* measure is used.



- The results also indicate that firms tend to offshore to riskier countries (i.e., countries with a relatively low Standard & Poor's rating), especially among developed countries. (against Hypothesis 2)
- Developed countries receiving offshoring flows are less sensitive to relative changes in the sovereign rating when we include all origin countries in the sample. (Hypothesis 2)
- Results using the *narrow* measure are more in line with intuition.



Thank you! drodrigue1@eafit.edu.co

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